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MORALITY BEFORE KNOWLEDGE

The impact of iron tablet administration and nutritional counseling: Hemoglobin level improvement in anemic pregnant women

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ABSTRACT

Objective: According to the 2013 Riskesdas, the prevalence of anemia in Indonesia was 37.1%. Data from the Pariaman City Health Office showed that the prevalence of anemia in 2014 was 43.1%. This study aims to determine the effect of iron (Fe) tablets and nutritional counseling on hemoglobin levels in pregnant women with anemia in the Pariaman City area in 2016. **Methods:** This study is a quantitative study using a quasi-experimental design. The study population consisted of third-trimester pregnant women with anemia, divided into two groups: the Fe tablet group (n=20) and the Fe tablet plus nutritional counseling group (n=20). Data analysis was performed using univariate and bivariate analysis with the Dependent T-Test statistical test. **Results:** The results showed that the average knowledge score in the Fe group was 0.3, while in the Fe plus nutritional counseling group it was 1.4. The average change in knowledge scores between the two groups showed a significant increase (p=0.002). The average attitude score in the Fe group was 2.15, while in the Fe plus nutritional counseling group it was 2.75. The average change in attitude scores between the two groups was not significant (p=0.205). The average action score in the Fe group was 1.050, while in the Fe plus nutritional counseling group it was 2.7. The average change in action scores between the two groups showed a significant increase (p=0.002). The average difference in hemoglobin levels in the Fe group was 0.280, while in the Fe plus nutritional counseling group it was 0.690. The average change in hemoglobin levels between the two groups showed a significant increase (p=0.008). **Conclusion:** It can be concluded that the provision of Fe supplementation and nutritional counseling results in a higher increase in hemoglobin levels compared to Fe tablets alone. It is hoped that nutritionists in the field will be more active in providing nutritional counseling to pregnant women with anemia to increase their knowledge about anemia. **Novelty/Originality of this article:** This study proposes an integrated nutritional intervention model combining Fe tablets with a community-based interactive nutritional counselling program. This model can increase the effectiveness of anaemia control programs in pregnant women by combining supplementation and education.

KEYWORDS: anemia; Fe tablet; nutritional counseling.

1. Introduction

One determinant of human resource quality is balanced nutrition (Mello et al., 2020). Malnutrition can lead to stunted physical growth, impaired cognitive development, decreased work productivity, and weakened immune systems, ultimately increasing morbidity and mortality rates (Amoadu et al. 2024). Four major nutritional issues in Indonesia that remain unresolved are Protein-Calorie Malnutrition (PCM), Vitamin A

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deficiency, endemic goiter, and anemia (Department of Health of the Republic of Indonesia, 2010; Department of Nutrition and Community Health, Faculty of Public Health UI, 2008).

Anemia in women of reproductive age can cause fatigue, weakness, and reduced work productivity (Chaparro et al., 2019). Pregnant women with anemia face a 3.6 times higher risk of mortality compared to non-anemic pregnant women. Anemia significantly contributes to mortality in Indonesia, ranging from 50-70%. Furthermore, anemia during pregnancy can lead to premature births, low birth weight infants (LBW), fetal abnormalities, and increased risk of fetal distress (Proverawati, 2009; Proverawati, 2011).

Anemia in pregnant women can result from various factors such as iron, folate, and vitamin B12 deficiencies, as well as diseases like malaria, hemolytic disorders, or sickle cell disease (Alene & Dohe, 2014). Poverty plays a significant role by limiting nutritional intake, exacerbating gender disparities, and contributing to insufficient knowledge about proper dietary habits (Siddiqui et al., 2020; Laraia et al., 2017; Agurs-Collins et al., 2024). One method to enhance public awareness of nutrition is through nutrition counseling. Following counseling, it is expected that individuals and families can take steps to address nutritional issues, including dietary changes and solutions towards healthier lifestyles (Helland e al., 2021; Silva et al., 2023).

Anemia ranks third globally among pregnant women with a prevalence of 74%. Anemia prevalence in Asia varies, with rates in Thailand at 39% and India at 85.5%. According to the World Health Organization (WHO) (2023), 30% (539 million) of non-pregnant women and 37% (32 million) of pregnant women aged 15–49 years were affected by anaemia. Based on the Household Health Survey in 2004, iron-deficiency anemia prevalence among pregnant women was approximately 40.1%, while the Basic Health Research/*Riset Kesehatan Dasar* (RISKESDAS) in 2013 indicated anemia prevalence among pregnant women in Indonesia was 37.1%, with similar rates in urban (36.4%) and rural areas (37.8%). These figures indicate a severe public health problem with anemia prevalence ≥40% (Department of Health of the Republic of Indonesia, 2004; Arisman, 2009; West Sumatra Provincial Health Office, 2015).

Various efforts have been made to prevent anemia in pregnant women, including increasing nutritional intake, iron supplementation programs, and government initiatives to distribute free Fe tablets to health services and maternal classes (Peña-Rosas et al., 2015; Zhao et al., 2015; Pasaribu et al., 2024). However, these efforts have proven inadequate, indicating ongoing challenges with anemia in pregnant women (Margawati et al., 2023). The government program to distribute Fe tablets for 90 days to pregnant women is commendable but has not significantly reduced the incidence of anemia in Indonesia (Noptriani & Simbolon, 2022). This suggests a more comprehensive and integrated approach may be needed to address this problem effectively.

Observations in Pariaman City over the past three years have shown that despite receiving Fe supplementation for 90 days, pregnant women with anemia also receive Additional Food Provision/*Pemberian Makanan Tambahan* (PMT). PMT for pregnant women with anemia in Pariaman City includes milk for pregnant women, green beans, eggs, sugar, and biscuits for 90 days. However, data shows that this PMT does not significantly increase hemoglobin levels in pregnant women with anemia, indicating that its current implementation is not optimal in improving nutritional status. This may be due to various factors, including the quality of the food provided, the timeliness of provision, or possible problems with nutrient absorption in pregnant women.

In addition to PMT, mother-class activities have been implemented in Pariaman City. These sessions only occur three times a year, with a limited number of mothers invited to each meeting. This limitation reduces the effectiveness of the mother class in preventing anemia in pregnant women in Pariaman City. The low frequency and limited participants may not be enough to provide the ongoing education and support needed for pregnant women to manage their health effectively. They are increasing the frequency of classes and expanding the reach of participants, which could positively impact the program.

Therefore, additional interventions are needed to address the problem of anemia in pregnant women in Pariaman City and reduce its incidence. A more holistic approach may

be needed, focusing on nutritional supplementation and considering other factors such as daily diet, lifestyle, and general health conditions of pregnant women (Nguyen et al., 2022; Brink et al., 2022) . In addition, increasing public awareness of the importance of preventing anemia during pregnancy can also help address this problem.

This study aims to determine the impact of Fe tablets and Nutrition Counseling on Hemoglobin levels in pregnant women with anemia. Combining iron supplementation with intensive nutritional counseling is expected to provide a more comprehensive approach to addressing anemia in pregnant women. Nutritional counseling can help pregnant women understand the importance of balanced nutritional intake and how to optimize iron absorption from food and supplements. In addition, this study can also provide valuable insights into the effectiveness of more integrated nutritional interventions in the context of maternal health in Indonesia.

2. Methods

This study was conducted in the Pariaman City area among pregnant women experiencing anemia in the third trimester. It employed a quantitative research method utilizing both secondary and primary data. Secondary data were obtained from the health profile of the Pariaman City Health Office and monthly reports, while primary data were collected from pregnant women experiencing anemia in the third trimester.

2.1 Research type and sample

This study was conducted in Pariaman City on pregnant women with anemia in the third trimester. The selection of this location and target group provides a specific context for the study, allowing researchers to evaluate the effectiveness of the intervention in an urban setting in Indonesia. The focus on pregnant women with anemia in the third trimester is significant, given that this period is critical for fetal development and maternal preparation for childbirth. This study used a quasi-experimental research design to examine the effect of iron tablet supplementation and nutritional counseling on increasing hemoglobin in pregnant women with anemia in Pariaman City. This quasi-experimental design allows researchers to evaluate the effects of the intervention in conditions that are close to the actual situation, where complete randomization may not be practical or ethical. This approach allows comparison between the groups receiving the intervention (iron tablet supplementation and nutritional counseling) and the control group while still considering external factors that may affect the results. Using a combination of iron tablet supplementation and nutritional counseling as an intervention demonstrates a holistic approach to the problem of anemia in pregnant women, which has the potential to provide more sustainable results than relying on supplementation alone.

The population for this study consisted of all third-trimester pregnant women with anemia in Pariaman City. Sample size determination was conducted using the Lemeshow formula. A significance level of 95% ($\alpha = 0.05$) and power of 90% ($\beta = 0.10$), standard deviation (σ) of 1.25, and an estimated difference in mean hemoglobin of 1.37 were assumed. Accounting for a 10% loss to follow-up, the minimum required sample size was calculated as (n = (10% x 18) + 18 = 19.8), rounded up to 20 anemic pregnant women per group. Considering two treatment groups, the total sample size was 40 anemic pregnant women, with 20 receiving only iron tablets and 20 receiving both iron tablets and nutritional counseling, randomized through simple random sampling.

2.2 Implementation of research (intervention)

All eligible pregnant women were randomly assigned to two study groups. Group I received daily iron tablet supplementation (1x1) for four weeks. Meanwhile, Group II received the same iron tablet regimen but was accompanied by nutritional counseling using a counseling booklet and Q&A method. Nutritional counseling sessions were conducted at

each participant's home, lasting between 30 and 60 minutes weekly. The nutritional counseling content included a comprehensive explanation of anemia, its causes and impacts on maternal and fetal health, and the benefits and potential side effects of iron supplementation.

Nutritional counseling aimed to improve pregnant women's understanding of the importance of iron in preventing anemia and how to optimize daily nutritional intake. In addition, counselors also provided practical guidance on iron-rich food sources and how to combine them with other foods to increase iron absorption. Each session ended with a Q&A session to ensure that all pregnant women truly understood the information provided and could apply it in their daily lives. After the four-week intervention period, the hemoglobin levels of pregnant women from both groups were re-checked using the Hemo Smart Gold device. The blood sampling process is done by trained medical personnel to ensure accurate results. Data obtained from hemoglobin examinations are then processed and analyzed to evaluate the interventions' effectiveness.

2.3 Research instruments

The instruments used in this study included several essential tools and forms. First, the Hemo Smart Gold device was used to measure the hemoglobin levels of pregnant women, providing accurate data on the anemia status of the participants. Second, a research questionnaire was developed to collect demographic information, health history, and nutritional habits of the participants. Third, the Initial and Final Hemoglobin Examination Form for Anemic Pregnant Women was used to record the results of hemoglobin measurements before and after the intervention.

The Hemo Smart Gold device provides fast and accurate hemoglobin measurements, allowing for efficient evaluation of changes in hemoglobin levels during the intervention. The research questionnaire included various questions designed to obtain a comprehensive picture of the health conditions and diets of the participants, as well as other factors that may affect their anemia status. The Initial and Final Hemoglobin Examination Form ensured that hemoglobin data were recorded adequately at two critical time points in the study: before and after iron supplementation and nutritional counseling.

Through the use of a combination of carefully selected instruments, this study gathered comprehensive and valid data to thoroughly assess the effectiveness of the intervention. By utilizing these tools, the research aimed to capture a holistic view of how iron supplementation, both independently and in conjunction with nutritional counseling, influenced hemoglobin levels and improved anemia status among pregnant women. The data collected were meticulously organized and will undergo rigorous statistical analysis to determine the extent to which these interventions contributed to enhancing the health outcomes of the participants, providing critical insights into their overall impact on maternal well-being.

2.4 Data collection procedure and data analysis

The primary data in this study were obtained through detailed measurements of hemoglobin levels among pregnant women in their third trimester, both before and after the intervention. The initial measurements provided a crucial baseline for assessing the severity of anemia prior to any treatment, while the post-intervention measurements evaluated the effects of iron supplementation and nutritional counseling on hemoglobin levels. Using the highly accurate Hemo Smart Gold device, the data collection process ensured precise readings. These results were then analyzed statistically to determine the overall effectiveness of the intervention in improving hemoglobin levels and addressing anemia among pregnant women in Pariaman City. The findings from this analysis are expected to provide valuable insights into improving maternal health outcomes in similar populations.

Data from the iron tablet group and the iron tablet plus nutritional counseling group were collected by directly measuring hemoglobin levels using the Hemo Smart Gold, alongside other demographic data including names, ages, parities, socioeconomic status (education, income). Measurement results were recorded in provided measurement sheets. Subsequently, respondents were given questionnaires regarding their knowledge, attitudes, and practices to be completed.

The data collected in this study underwent univariate and bivariate analysis to provide a comprehensive picture of the characteristics of the participants and the relationships between variables. The univariate analysis produced distributions and percentages for each variable studied, including adherence to iron supplement intake, age, maternal education, family income, parity, initial hemoglobin levels, final hemoglobin levels, knowledge, attitude, and practice scores.

The purpose of this analysis was to describe the characteristics of each variable in detail, thus providing an initial picture of the conditions and backgrounds of the study participants. Bivariate analysis was conducted to test the relationship between the independent and dependent variables. The Dependent T-test was used to compare the results of the two sample groups before and after the intervention to provide changes in hemoglobin levels that occurred as a result. This technique allows researchers to determine whether there is a significant difference in hemoglobin levels before and after the intervention and to see whether additional nutritional counseling provides more benefits than iron supplementation alone. The results of this analysis are essential to determine the effectiveness of the intervention provided and provide insight into the factors that influence hemoglobin levels in pregnant women with anemia.

3. Results and Discussion

Respondents in this study were anemic pregnant women meeting inclusion and exclusion criteria in the Pariaman City region, covering seven community health centers: Pauh Pariaman Health Center, Kurai Taji Health Center, Marunggi Health Center, Santok Health Center, Kp Baru Padusunan Health Center, Naras Health Center, and Sikapak Health Center.

3.1 Respondent characteristics

Anemia during pregnancy is defined as maternal hemoglobin levels below 11 g/dL in the first and third trimesters or hemoglobin < 10.5 g/dL in the second trimester (Depkes RI, 2009). Anemia results in a reduction of red blood cells or hemoglobin, thereby diminishing the oxygen-carrying capacity for vital organs in both the mother and fetus (Varney, 2006). Based on respondent characteristics regarding age, it was observed that the same percentage of respondents in both the iron tablet group and the iron tablet plus nutritional counseling group were not at risk, with 16 respondents (80%) not at risk and the remaining 4 respondents (20%) at risk for pregnancy (Table 1). According to research by Kwak et al (2022), the age of the mother during pregnancy significantly influences the occurrence of anemia

The age of a mother is related to women's reproductive organs. Pregnancy at ages < 20 years and > 35 years can cause anemia because biologically, those under 20 are not yet optimal; they tend to be emotionally unstable, and their mental maturity is not fully developed, making them prone to disturbances that result in insufficient attention to meeting nutritional needs during pregnancy. Meanwhile, at age > 35, there is physical decline and decreased immune function, along with various diseases that often occur at an early age (Dimitriadi et al., 2023).

Regarding parity, 19 respondents (95%) in the iron group were in the low-risk parity group, having given birth less than 4 times, while 1 respondent (5%) was in the high-risk group. In the iron plus nutritional counseling group, 18 respondents (90%) were in the low-risk parity group, and 2 respondents (10%) were in the high-risk group, having given birth

more than 4 times. Parity refers to the number of children born to a mother, whether alive or stillborn. Mothers who give birth frequently are at risk of experiencing anemia in subsequent pregnancies if nutritional needs are not met. According to Al-Farsi et al. (2011) research, there is a correlation between parity and the occurrence of anemia in pregnant women; those with high parity have a 2.92 times greater risk of experiencing anemia compared to those with low parity.

Table 1 Frequency distribution of respondent characteristics in each treatment group of anemic pregnant women

Characteristics of Mothers	Fe Group		Fe + KG Group	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Mother's Age				
At Risk <20 and >35	4	20.0	4	20.0
Not at Risk	16	80.0	16	80.0
Total	20	100.0	20	100.0
Parity				
At Risk > 4 times	1	5.0	2	10.0
Not At Risk < 4 times	19	95.0	18	90.0
Total	20	100.0	20	100.0
Pregnancy Interval				
< 2 Years	1	5.0	2	10.0
> 2 Years	19	95.0	18	90.0
Total	20	100.0	20	100.0
Education Level				
Didn't graduate from elementary school	0	0.0	1	5.0
Graduated from elementary school/equivalent	0	0.0	1	5.0
Junior high shcool/equivalent	3	15.0	1	5.0
Senior high school/equivalent	7	35.0	11	55.0
Academy	10	50.0	6	30.0
Total	20	100.0	20	100.0
Type of Occupation				
Unemployed/ Housewife	13	65.0	14	70.0
Government Employee	4	20.0	3	15.0
Private sector employee	1	5.0	1	5.0
Others	2	10.0	2	10.0
Total	20	100	20	100.0

Based on respondents with a safe interval for pregnancy (more than 2 years), in the iron group, 19 respondents (95%) were in the safe interval group, while 1 respondent (5%) was in the unsafe group (less than 2 years). In the iron plus nutritional counseling group, 18 respondents (90%) were in the safe interval group, while 2 respondents (10%) were in the unsafe group. A closely spaced birth interval can cause anemia because the mother's condition has not fully recovered, and nutritional needs are not optimal, requiring her to meet the nutritional needs of the fetus (Gibore et al., 2020; Afeworki et al., 2015). According to Amiruddin (2007) study, a closely spaced birth interval carries a 2.56 times greater risk of anemia occurrence.

Looking at the respondents' educational background, the same percentage was observed between the iron group and the iron plus nutritional counseling group; 17 respondents (85%) had education above high school level, while 3 respondents (15%) had education below high school level. The higher the formal education level, the higher the health education level is expected to be. Education significantly influences improved

thinking ability; in other words, individuals with higher education are more likely to make rational decisions and are generally open to accepting changes or new things compared to those with lower education levels (Depkes RI, 2009). Pregnant women with lower education levels are at higher risk of anemia because lower education leads to less knowledge about anemia, limited access to information, and health services. Regarding their employment status, in the iron group, the majority of respondents were homemakers (65%), 20% were civil servants, 5% were private employees, and 10% were others. In the iron plus nutritional counseling group, 70% were homemakers, 15% were civil servants, 5% were private employees, and 10% were others. Working outside the home is one of the indirect causes of nutritional anemia in pregnant women. This is especially true if the type of work requires physical exertion and the mother does not have specific time to rest at home (Depkes RI, 2009).

3.2 Family characteristics

Based on Table 2, it can be seen that in the iron group, 17 respondents (85%) had incomes above the regional minimum wage/*Upah Minimum Regional* (UMR), while 3 respondents (15%) had incomes below the UMR. In the iron plus nutritional counseling group, 10 respondents (50%) had incomes above the UMR, while 10 respondents (50%) had incomes below the regional minimum wage.

Table 2 Frequency distribution of family characteristics based on income in each treatment group of anemic pregnant women

Income	Treatment I		Treatment II	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Below min. wage (< IDR 1,800,725)	3	15	10	50
Above min. wage (> IDR 1,800,725)	17	85	10	50
Total	20	100	20	100

Poverty and malnutrition are interconnected phenomena; therefore, improving the nutritional status of the community is closely related to efforts to enhance economic conditions (Siddiqui et al., 2020). The amount of food a family has is influenced by its economic status. One measure of economic status is the total family income. Higher income levels provide families with greater opportunities to choose both the quantity and quality of food. However, spending more on food does not guarantee a diverse diet.

3.3 Difference in nutritional knowledge of anemic pregnant women

Based on Table 3, it is known that the average nutritional knowledge score of respondents in the iron group was 18.2, which increased to 18.5 after receiving iron tablets. Meanwhile, in the iron plus nutritional counseling group, the average knowledge score of respondents before treatment was 9.5 and increased to 11 after receiving iron tablets and nutritional counseling (Table 3).

Table 3 The average difference in knowledge scores of pregnant women with anemia between the Fe group and the Fe + nutrition counseling group

Fe Group	Mean	± SD	SE	Difference	p-value
Fe Group					
Before	18.2	2.5047	0.5601	0.3	0.267
After	18.5	2.4602	0.5501		
Fe+Nutrition Counseling Group					
Before	9.575	0.8511	0.1903	1.425	0.000
After	11.000	0.5257	0.1175		

Based on the statistical analysis, it is found that the average difference in knowledge scores in the iron tablet group is 0.3, while in the iron tablet + nutritional counseling group, the average difference in knowledge scores is 1.4. The difference in knowledge scores between the iron tablet group and the iron tablet + nutritional counseling group is 1.1. The analysis results indicate that there is a statistically significant difference in knowledge scores between the group that received iron tablets + nutritional counseling compared to those who received only iron tablets, with a p-value of 0.00 ($p < 0.05$) (Table 4).

Table 4 Difference in knowledge level scores between the Fe Group and the Fe + nutrition counseling group among pregnant women with anemia

Group	Mean	± SD	SE	Difference	p-value
Knowledge					
Fe	0.3	1.1743	0.2626	1.1	0.002
Fe + Nutrition Counseling	1.4	0.8889	0.1988		
Nutritional Attitude					
Fe	2.150	1.3485	0.3015	0.6	0.205
Fe + Nutrition Counseling	2.750	1.5853	0.3545		
Nutritional Action					
Fe	1.050	0.9987	0.2233	1.65	0.002
Fe + Nutrition Counseling	2.700	1.9494	1.9494		

Based on the analysis provided, there is a significant improvement in pregnant women's knowledge about anemia after receiving nutritional counseling intervention, especially when compared to the group receiving only iron tablets. This highlights the crucial role of nutritional counseling in enhancing pregnant women's understanding of anemia and the importance of proper nutritional intake.

In this study, nutritional counseling was conducted continuously over 4 sessions, covering various topics and including question-and-answer sessions with the respondents. The use of a booklet during nutritional counseling also helped clarify the messages conveyed and improved the respondents' ability to remember the information provided. These research findings are consistent with previous studies showing that nutritional counseling can significantly enhance respondents' knowledge regarding nutritional intake and health. For example, Febrianti et al. (2024) demonstrated that providing nutritional counseling to mothers could increase their knowledge, as evidenced by a significant increase in knowledge scores with a p-value of 0.000. In addition to knowledge, the attitude of pregnant women towards nutrition also improved after receiving nutritional counseling. In your study, it is evident that the average nutrition attitude scores increased significantly after nutritional counseling intervention, both in the group receiving only iron tablets and in the group receiving iron tablets plus nutritional counseling.

Overall, these results underscore the importance of nutritional counseling in improving pregnant women's understanding and attitude towards nutrition, particularly in the context of preventing and managing anemia during pregnancy. This also highlights that a comprehensive approach, including regular education and counseling, can have a positive impact on the health of pregnant women and their unborn babies.

Based on the analysis, the average difference in nutrition attitude scores was 2.150 in the iron tablet group (Fe), while it was 2.750 in the iron tablet plus nutritional counseling group (Fe + nutritional counseling). The difference in attitude scores between the Fe group and the Fe + nutritional counseling group was 0.6. The statistical analysis showed that there was no significant difference in nutrition attitude scores between the group that received Fe + nutritional counseling and the group that received Fe alone, with a p-value of 0.205 ($p > 0.05$) (Table 5).

This indicates that both the Fe group and the Fe + nutritional counseling group showed improved attitudes among pregnant women towards nutrition after receiving the intervention for 4 weeks. Tiara Rosiana H's study in 2013 demonstrated that nutritional counseling provided to respondents could improve their attitudes towards positive

changes. The analysis with a p-value of 0.000 indicated a significant effect of nutritional counseling on improving mothers' attitudes towards child feeding and nutritional intake among children with stunting aged 1-2 years in Semarang Timur District (Hestuningtyas, 2013).

Table 5 The average difference in nutritional attitude scores of pregnant women with anemia between the Fe group and the Fe + nutrition counseling group

Group	Mean	± SD	SE	Difference	p-value
Fe Group					
Before	36.6	4.882	1.092	2.15	0.000
After	38.75	4.633	1.036		
Fe + Nutrition Counseling Group					
Before	38.0	4.920	1.100	2.75	0.000
After	40.75	4.940	1.105		

Attitude is defined as a person's reaction or response that is still closed towards a stimulus or object. It represents predispositions to action or behavior. Attitude is an evaluative form and a reaction of feelings. Positive improvements in attitudes among mothers are highly anticipated in the implementation of health counseling, where attitude serves as a determinant of actions (Mannava et al., 2015). According to this research, on average, mothers already have a fairly positive attitude towards managing nutritional anemia; however, they may not consistently apply these principles in their daily lives. Therefore, the occurrence of anemia remains prevalent among pregnant women.

3.4 Difference in nutritional actions of pregnant women with anemia between Fe and Fe + nutritional counseling groups

Based on Table 6, it is known that the average nutritional action score of respondents in the Fe group before treatment was 19.65 and increased to 20.20 afterward. Meanwhile, in the Fe + Nutritional Counseling group, the average nutritional action score before treatment was 20.40, which increased to 23.10 after treatment.

Table 6 The average difference in nutritional action scores of pregnant women with anemia between the Fe group and the Fe + nutrition counseling group

Group	Mean	± SD	SE	Difference	p-value
Fe Group					
Before	19.65	3. 937	0.2256	0.55	0.009
After	20.20	3.665	0.2052		
Fe + Nutrition Counseling Group					
Before	20.40	4.198	0.939	2.7	0.000
After	23.10	3.726	0.833		

Based on the analysis, it is found that the average difference in nutrition action scores in the iron tablet group (Fe) was 1.050, while in the iron tablet plus nutritional counseling group (Fe + nutritional counseling) it was 2.700. The difference in action scores between the Fe group and the Fe + nutritional counseling group was 1.65. The statistical analysis showed a significant difference in nutrition action scores between the group receiving Fe + nutritional counseling and the group receiving Fe alone, with a p-value of 0.002 ($p < 0.05$). This indicates an improvement in nutritional actions among respondents towards a better direction after receiving Fe + nutritional counseling for 4 weeks compared to those who received only iron tablets.

This research aligns with Seid & Babbel (2023) which demonstrated that nutritional counseling provided to respondents could improve their behaviors. Notoatmodjo (2007) stated that attitudes may not necessarily translate into actions because actions require other factors such as facilities or infrastructure as mediators for attitudes to turn into

actions. Besides facility factors, support from other parties is also needed. This practice has several levels.

Knowledge is crucial for forming someone's actions. If behaviors are based on knowledge and positive attitudes, those behaviors will be sustainable (Vance & Brandon, 2017). Conversely, behaviors not rooted in knowledge and awareness will not last long. Based on this research, after receiving counseling for 4 weeks, respondents showed significant improvements in handling anemia among pregnant women. This was supported by their adequate knowledge of anemia and positive attitudes, leading to the formation of favorable behaviors. Nutritional counseling for pregnant women with anemia can improve their dietary patterns (Balcha et a., 2023), enhancing iron absorption in their bodies. For instance, mothers no longer consume iron tablets with tea or coffee, and they consume vitamin C, which aids iron absorption in the body.

3.5 Difference in Hemoglobin (Hb) levels before and after administration of Fe and Fe + nutritional counseling

According to Table 7, the average Hb level in the Fe group before intervention was 9.160 g/dl. After intervention, the Hb level increased to an average of 9.440 g/dl. In the Fe + Nutritional Counseling group, the average Hb level before treatment was 9.430 g/dl, which increased to 10.120 g/dl after receiving iron tablets and nutritional counseling.

Table 7 The average difference in hemoglobin levels before and after administration of Fe tablets and Fe + nutrition counseling in pregnant women with anemia

Group	Mean	± SD	SE	Difference	p-value
Fe Group					
Before	9.160	1.0091	0.2256	0.28	0.009
After	9.440	0.9179	0.2052		
Fe + Nutrition Counseling Group					
Before	9.430	1.2901	0.2885	0.69	0.000
After	10.120	0.8835	0.1976		

After 4 weeks of intervention, a significant increase in the average hemoglobin (Hb) levels was observed between before and after the intervention in the iron supplementation group. The average increase in Hb levels was 0.28 g/dl. Similarly, in the iron supplementation and Nutritional Counseling group, there was an average increase in Hb levels of 0.690 g/dl. Statistical analysis results indicate a significant increase with a p-value of 0.008 (Table 8). It is evident that with the provision of both iron and Nutritional Counseling, the average increase in Hb levels is much higher compared to providing only iron tablets.

Table 8 The difference in hemoglobin level improvement between the Fe group and the Fe + nutrition counseling group among pregnant women with anemia

Group	Mean	± SD	SE	Difference	p-value
Fe	0.280	0.4324	0.967	0.41	0.008
Fe + Nutrition Counseling	0.690	0.4855	0.1086		

The increase in Hb levels in both groups varied, which could be due to several factors such as the respondents' age, gestational age, parity, and their dietary patterns. The increase in Hb levels could also be attributed to the respondents' compliance with consuming iron tablets, as other family members were involved in monitoring their tablet intake during the study. This study aligns with research conducted by Sloan et al., (2002), which examined the joint effect of folate and iron supplementation (average daily doses: 66 ± 18 mg of iron and 4.6 ± 0.5 mg of folate) on maternal hematologic changes exceeded that of folate supplementation alone (average daily dose: 4.7 ± 0.4 mg of folate), resulting in an increase of 1.22 ± 0.047 g/dL (df = 3, P < .001).

Nutritional counseling is an approach used in nutritional care to help individuals and families gain a better understanding of themselves and the issues they face. The goal of nutritional counseling is to assist clients in efforts to change behaviors related to nutrition and health, thereby improving their nutritional status and overall health (Dewidar et al., 2023). In the group receiving iron tablets and Nutritional Counseling, the effect of nutritional counseling on increasing maternal hemoglobin levels after treatment was evident. This could be attributed to the four counseling sessions conducted weekly, which provided information and knowledge to pregnant women about anemia. This contributed to changes in their daily behaviors, particularly in increasing hemoglobin levels in pregnant women with anemia.

In this study, the average increase in maternal Hb levels in the Fe group was 0.28 g/dl, while in the Fe + nutritional counseling group, it was 0.690 g/dl. These results differ from previous literature and research which states that regular consumption of iron supplements can increase maternal Hb levels (Stoffel et al., 2020). This difference could be due to several reasons: (1) The characteristics of pregnant women in previous studies differ from those in the current study. Previous studies used iron supplements with 200 mg of ferrous sulfate twice a day, equivalent to 200 mg of iron/day, while in this study, the research sample was given iron supplements containing 200 mg of ferrous sulfate once a day, equivalent to 60 mg of iron/day. Therefore, the increase in Hb levels observed in this study is lower compared to previous studies; (2) The increase in maternal Hb levels is not solely influenced by iron supplements but is also supported by dietary consumption of iron-rich foods, particularly heme iron from animal sources with absorption rates up to 25%, as well as green vegetables as good sources and fruits as sources of vitamin C, which aids in iron absorption in the body.

4. Conclusions

In the Fe group, the average knowledge score increased from 18.2 to 18.5 after receiving iron tablets. Meanwhile, in the Fe + Nutritional Counseling group, the average knowledge score increased from 9.5 to 11.00. The average attitude score in the Fe group increased from 36.6 to 38.7 after iron tablet administration, whereas in the Fe + Nutritional Counseling group, it increased from 38 to 40.75. The average action score in the Fe group increased from 19.65 to 20.20 after iron tablet administration, while in the Fe + Nutritional Counseling group, it increased from 20.40 to 23.10. The average hemoglobin levels in the Fe group increased from 9.16 to 9.440 after iron tablet administration, and in the Fe + Nutritional Counseling group, it increased from 9.430 to 10.12.

There were significant differences in the average knowledge score improvement among respondents after receiving Fe + Nutritional Counseling compared to those who only received iron tablets. However, there were no significant differences in the average attitude score improvement among respondents after Fe + Nutritional Counseling compared to those who only received iron tablets. There were significant differences in the average action score improvement among respondents after Fe + Nutritional Counseling compared to those who only received iron tablets. Additionally, there were significant differences in the average hemoglobin levels after Fe + Nutritional Counseling compared to those who only received iron tablets.

Anemia is a pregnancy-related issue that requires special attention. It is hoped that pregnant women with anemia receive special attention and family support in managing anemia during pregnancy, thereby avoiding the potential impacts of anemia on pregnant women. Moreover, for field workers, especially nutritionists, providing weekly nutritional counseling to pregnant women with anemia is crucial. This is because there is still insufficient knowledge among pregnant women about the dangers of anemia during pregnancy. Through nutritional counseling, mothers gain better awareness about anemia, which can lead to improved behaviors in managing anemia during pregnancy.

The limitations of this study include the use of digital devices, specifically the Hemo Smart Gold, for measuring respondents' hemoglobin (Hb) levels. This was due to the

absence of cyanmethemoglobin method for Hb testing in all health centers in the city of Pariaman. Furthermore, during the implementation of nutritional counseling, there could have been biases because the counseling sessions took place at respondents' homes, where interruptions from the respondents' children were frequent. To minimize this bias, the researcher sought assistance from other family members to supervise the children while conducting counseling sessions with the respondents. Despite these limitations, this study is expected to be beneficial in addressing the occurrence of anemia in pregnant women in the city of Pariaman and can serve as a guideline for pregnant women.

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Author Contribution
All authors conceived and designed the study, performed the experiments, analyzed and interpreted the data, contributed reagents/materials/analysis tools, wrote the paper, prepared figures and/or tables, reviewed drafts of the paper and approved the final draft.

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